(19) World Intellectual Property Organization International Bureau



(43) International Publication Date 21 April 2005 (21.04.2005)

PCT

(10) International Publication Number WO 2005/036657 A1

(51) International Patent Classification7:

H01L 33/00

(21) International Application Number:

PCT/JP2004/015449

- (22) International Filing Date: 13 October 2004 (13.10.2004)
- (25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2003-354240 60/513,198 14 October 2003 (14.10.2003) JP 23 October 2003 (23.10.2003) US

- (71) Applicant (for all designated States except US): SHOWA DENKO K.K. [JP/JP]; 13-9, Shibadaimon 1-chome, Minato-ku, Tokyo 1058518 (JP).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): WATANABE, Munetaka [JP/JP]; c/o SHOWA DENKO K.K., 1-1, Ohnodai 1-chome, Midori-ku, Chiba-shi, Chiba 2670056 (JP).

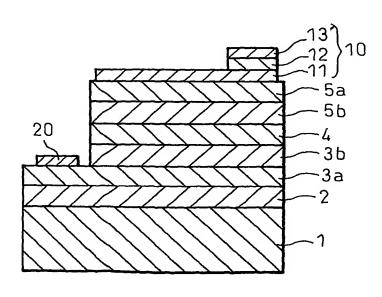
- (74) Agents: AOKI, Atsushi et al.; A. AOKI, ISHIDA & AS-SOCIATES, Toranomon 37 Mori Bldg., 5-1, Toranomon 3-chome, Minato-ku, Tokyo 1058423 (JP).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

with international search report

[Continued on next page]

(54) Title: GALLIUM NITRIDE-BASED COMPOUND SEMICONDUCTOR LIGHT-EMITTING DEVICE, POSITIVE ELECTRODE FOR THE DEVICE, LIGHT-EMITTING DIODE AND LAMP USING THE DEVICE



(57) Abstract: An object of the present invention is to provide a flip-chip-type gallium nitride compound semiconductor light-emitting device excellent ohmic characteristics. exhibiting excellent bonding characteristics, and high emission output. The inventive flip-chip-type gallium nitride compound semiconductor light-emitting device comprises a substrate, an n-type semiconductor layer, a light-emitting layer, a p-type semiconductor layer, a negative electrode provided on the n-type semiconductor layer, and a positive electrode provided on the p-type semiconductor layer, the layers being successively provided atop the substrate in this order and being composed of a gallium nitride compound semiconductor, wherein the positive electrode has a three-layer structure comprising an ohmic electrode layer which is in contact with the p-type semiconductor layer, an adhesion layer which is provided on the ohmic electrode layer, and a bonding pad layer provided on the adhesion layer, each melting point of these layers being lowered in this order.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.